MULTIMEDIA UNIVERSITY STUDENT IDENTIFICATION NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2017/2018

BST1034 – STATISTICS FOR MANAGERS

(All sections / Groups)

14 OCTOBER 2017
2:30 p.m. – 4:30 p.m.
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This question paper consists of **8** printed pages excluding the cover page, with **4** questions only.

2. Attempt **ALL** the questions. All questions carry equal marks and the distribution of the marks for each question is given.

3. Students are allowed to use non-programmable scientific calculators (without restriction).

4. All necessary workings must be shown and please write all your answers in the answer booklet provided.

QUESTION 1:

a. The data of the average age (in year) of oil palm trees in a sample of ten plantations in Melaka in 2016 is as follows:

22 20 12 25 16 12 18 16 24 14

i. Find the median of the data. (2 marks)
ii. Determine the mean of the data. (2 marks)
iii. Calculate the standard deviation of the data. (3 marks)
iv. Describe the shape of the data. (2 marks)

b. An oil palm plantation purchases 64% and 36% of the fertilizers from two suppliers: A and B respectively. The oil palm trees in the plantation were fertilized with only one type of the fertilizer throughout their lifetime. The manager of the plantation found that 86% and 92% of the high quality fresh fruit bunches were produced by the oil palm trees that used the fertilizers supplied by supplier A and supplier B, respectively.

i. Draw a complete tree diagram to represent the situation. (4 marks)
ii. If the manager chosen a high quality fresh fruit bunches, what is the probability that the oil palm tree used the fertilizer supplied by supplier A? (3 marks)
iii. If the manager chosen a low quality fresh fruit bunches, what is the probability that the oil palm tree used the fertilizer supplied by supplier B? (3 marks)

c. The following are the prices and quantities of three type of chips consumed by consumers in year 2015 and 2016:

Type of chips	Year (2015)		Year (2016)	
	Price (RM)	Quantity	Price (RM)	Quantity
Banana chips	1.6	1000	1.8	1200
Corn chips	2.5	960	2.7	880
Potato chips	3.8	1325	4.0	1380

i. Calculate a Paasche aggregate price index for year 2016, using 2015 as the base year. (3 marks)
ii. Calculate a Laspeyres aggregate price index for year 2016, using 2015 as the base year. (3 marks)

(Total: 25 Marks)

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QUESTION 2:

a. The following data presents the number of home sales (in nearest thousand) of a sample of ten cities in Malaysia in 2016.

7 15 9 7 8 5 6 11 7 10

Construct a 99% confidence interval for the mean number of home sales in all cities. (7 marks)

b. The government reports that 40% of all the home sale prices last year are above five hundred thousand. A recent random sample of 120 home sales data shows that 54 units were sold at prices above five hundred thousand. By assuming the population is normally distributed, can we conclude that the proportion of home sale priced above five hundred thousand has increased as compared to last year at 1% level of significance? (9 marks)

c. The following sample data reports the sample mean, sample size, and the population variance of home sales in two neighbouring countries respectively.

Country A	Country B
$\bar{x}_A = 178$	$\bar{x}_B = 166$
$n_A = 136$	$n_B = 128$
$\sigma_A^2 = 2612$	$\sigma_B^2 = 3284$

Can we conclude that the population mean home sales in country A is higher than the one in country B at the 2.5% significance level? (9 marks)

(Total: 25 Marks)

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QUESTION 3:

a. A property agent is analysing the home sale prices in Johor, Melaka and Negeri Sembilan. The descriptive statistics and the partially completed analysis of variance table of the mean home sale prices (in RM thousand) in the three states are presented in the following tables:

SUMMARY

City	Count	Mean	Variance
Johor	88	312	232.6
Melaka	64	358	169.6
Negeri Sembilan	46	298	124.4

ANOVA

Source of Variation	*SS*	*df*	*MS*
Between Groups	8036.7	***	***
Within Groups	***	195	***
Total	***	197	

i. Compute the sum of squares within (*SSW*) the groups and hence complete the ANOVA table. (5 marks)

ii. If the populations have equal variances and are normally distributed, can the property agent conclude that there is a difference in the mean home sale prices in the states at the 5% significance level? (8 marks)

b. A property agent would like to find out whether the home sale price (in RM thousand) and the distance to the nearest school (in kilometre, km) are related. The information of eighty randomly selected home sales is presented in the following table:

Home sale price (RM '000)	Distance to the nearest school (km)		
	2 – 5	6 – 9	10 – 13
201 – 350	12	7	11
351 – 500	8	9	7
501 – 650	7	13	6

Is there a relationship between the home sale price and the distance to the nearest school at the 10% significance level? (12 marks)

(Total: 25 Marks)

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QUESTION 4:

a. Research has shown that the production of honey (in metric tonnes) depends on the air quality index, AQI (0 – 500). The following data are collected from a random sample of twelve countries:

AQI	48	72	115	35	119	47	141	92	76	135	100	85
Honey production	123	116	56	168	49	145	47	104	138	50	67	122

i. Compute the coefficient of correlation. (3 marks)
ii. Find the regression line of the honey production. (6 marks)

b. The following are the partially completed output of the honey production (in metric tonnes) regressed on four independent variables:

Source of Variation	*SS*	*df*	*MS*
Regression	842.11	4	***
Residual	***	***	***
Total	5910.63	126	

Variable	*t Stat*
Rainfall	– 2.558
Location of beehives	1.703
Air quality index	2.675
Number of beehives	2.954

i. Complete the ANOVA table. (2 marks)
ii. Test whether the regression model is statistically significant at 5% significance level. (8 marks)
iii. Test the significance of each variable, individually, at 1% significance level. (6 marks)

(Total: 25 Marks)

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APPENDIXES:

I. STATISTICAL FORMULAE

A. DESCRIPTIVE STATISTICS

Ungrouped Data:

Sample Mean, $\bar{x} = \frac{\sum x}{n}$ Sample Standard Deviation, $s = \sqrt{\frac{\sum x^2}{n-1} - \frac{(\sum x)^2}{n(n-1)}}$

Grouped Data:

Sample Mean, $\bar{x} = \frac{\sum fx}{\sum f}$ Sample Standard Deviation, $s = \sqrt{\frac{\sum fx^2}{\sum f - 1} - \frac{(\sum fx)^2}{\sum f(\sum f - 1)}}$

Median $= L_m + \left[\frac{\left(\frac{\sum f}{2} - F_{m-1}\right)}{f_m}\right]c$ Mode $= L_m + \left[\frac{(f_m - f_{m-1})}{2f_m - f_{m-1} - f_{m+1}}\right]c$

B. PROBABILITY DISTRIBUTION

Poisson Probability Distribution

If X follows a Poisson Distribution P (λ) where $P(X = x) = \frac{\lambda^x e^{-\lambda}}{x!}$

then the mean = E(X) = λ and variance = VAR(X) = λ

Binomial Probability Distribution

If X follows a Binomial Distribution B(n, p) where $P(X = x) = {}^nC_x p^x q^{n-x}$

then the mean = E(X) = np and variance = VAR(X) = npq where $q = 1-p$

Normal Distribution

If $X \sim N(\mu, \sigma)$ where E(X) = μ and VAR(X) = σ^2, then $Z = \frac{X - \mu}{\sigma}$

C. CONFIDENCE INTERVAL ESTIMATION AND SAMPLE SIZE DETERMINATION

If σ known, $(100-\alpha)\%$ Confidence Interval for Population Mean, μ: $\bar{x} \pm Z_{\alpha/2}\frac{\sigma}{\sqrt{n}}$

If σ unknown, $(100-\alpha)\%$ Confidence Interval for Population Mean, μ: $\bar{x} \pm t_{\alpha/2,n-1}\frac{s}{\sqrt{n}}$

$(100-\alpha)\%$ Confidence Interval for Population Proportion, p: $p \pm Z_{\alpha/2}\sqrt{\frac{p(1-p)}{n}}$

Sample Size Determination for Population Mean: $n \geq \frac{(Z_{\alpha/2})^2\sigma^2}{E^2}$

Sample Size Determination for Population Proportion: $n \geq \frac{(Z_{\alpha/2})^2 p(1-p)}{E^2}$

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D. HYPOTHESIS TESTING

One Sample Mean Test

Z-test: $Z = \dfrac{\bar{x} - \mu}{\dfrac{\sigma}{\sqrt{n}}}$ *t*-test: $t = \dfrac{\bar{x} - \mu}{\dfrac{s}{\sqrt{n}}}$

One Sample Proportion Test

$$Z = \frac{p - \pi}{\sqrt{\dfrac{\pi(1-\pi)}{n}}}$$

Two Sample Mean Test

Z-test: $Z = \dfrac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{\sqrt{\dfrac{\sigma_1^2}{n_1} + \dfrac{\sigma_2^2}{n_2}}}$

t-test: $t = \dfrac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{s_p\sqrt{\left(\dfrac{1}{n_1} + \dfrac{1}{n_2}\right)}}$ where $s_p = \sqrt{\dfrac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}}$

Two Sample Proportion Test

$$Z = \frac{(p_1 - p_2) - (\pi_1 - \pi_2)}{\sqrt{\bar{p}(1-\bar{p})\left[\dfrac{1}{n_1} + \dfrac{1}{n_2}\right]}} \quad \text{where} = \bar{p} = \frac{x_1 + x_2}{n_1 + n_2}$$

E. ANALYSIS OF VARIANCE

$$SST = \sum_{i=1}^{k}\sum_{j=1}^{n_j}\left(X_{ij} - \bar{\bar{X}}\right)^2 \qquad SSB = \sum_{i=1}^{k} n_i\left(\bar{X}_i - \bar{\bar{X}}\right)^2$$

$$SSW = \sum_{i=1}^{k}(n_i - 1)s_i^2 \quad \text{or} \quad SSW = \sum_{i=1}^{k}\sum_{j=1}^{n_j}\left(x_{ij} - \bar{x}_i\right)^2$$

F. CHI-SQUARE ANALYSIS

Expected cell frequencies for Independent Test: $E_i = \dfrac{Row\ total \times Column\ total}{N}$

Chi-Square test statistic: $\chi^2 = \sum \dfrac{(O_i - E_i)^2}{E_i}$

O_i = Observed frequency in a particular cell

E_i = expected frequency in a particular cell

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G. REGRESSION ANALYSIS

Correlation Coefficient: $$r = \frac{n\sum xy - \sum x \sum y}{\sqrt{[n\sum x^2 - (\sum x)^2][n\sum y^2 - (\sum y)^2]}}$$

Simple Linear Regression: $Y = a + bX$ where $$b = \frac{\sum xy - \frac{\sum x \sum y}{n}}{\sum x^2 - \frac{(\sum x)^2}{n}}$$ and

$$a = \bar{y} - b\bar{x}$$

H. INDEX NUMBERS

Simple Price Index $P = \frac{p_t}{p_0} \times 100$	**Laspeyres Quantity Index** $P = \frac{\sum p_0 q_t}{\sum p_0 q_0} \times 100$
Simple Aggregate Price Index $P = \frac{\sum p_t}{\sum p_0} \times 100$	**Paasche Quantity Index** $P = \frac{\sum p_t q_t}{\sum p_t q_0} \times 100$
Laspeyres Price Index $P = \frac{\sum p_t q_0}{\sum p_0 q_0} \times 100$	**Fisher's Ideal Price Index** $\sqrt{(\text{Laspeyres Price Index})(\text{Paasche Price Index})}$
Paasche Price Index $P = \frac{\sum p_t q_t}{\sum p_0 q_t} \times 100$	**Value Index** $V = \frac{\sum p_t q_t}{\sum p_0 q_0} \times 100$

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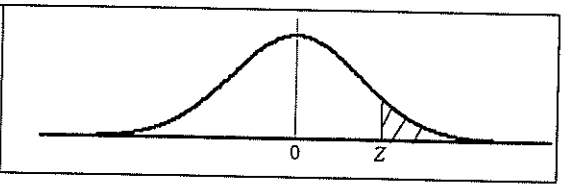
II. STATISTICAL TABLE

Table 1

The Upper Tail Area Under the Standard Normal Curve



Z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.4960	0.4920	0.4880	0.4840	0.4801	0.4761	0.4721	0.4681	0.4641
0.1	0.4602	0.4562	0.4522	0.4483	0.4443	0.4404	0.4364	0.4325	0.4286	0.4247
0.2	0.4207	0.4168	0.4129	0.4090	0.4052	0.4013	0.3974	0.3936	0.3897	0.3859
0.3	0.3821	0.3783	0.3745	0.3707	0.3669	0.3632	0.3594	0.3557	0.3520	0.3483
0.4	0.3446	0.3409	0.3372	0.3336	0.3300	0.3264	0.3228	0.3192	0.3156	0.3121
0.5	0.3085	0.3050	0.3015	0.2981	0.2946	0.2912	0.2877	0.2843	0.2810	0.2776
0.6	0.2743	0.2709	0.2676	0.2643	0.2611	0.2578	0.2546	0.2514	0.2483	0.2451
0.7	0.2420	0.2389	0.2358	0.2327	0.2296	0.2266	0.2236	0.2206	0.2177	0.2148
0.8	0.2119	0.2090	0.2061	0.2033	0.2005	0.1977	0.1949	0.1922	0.1894	0.1867
0.9	0.1841	0.1814	0.1788	0.1762	0.1736	0.1711	0.1685	0.1660	0.1635	0.1611
1.0	0.1587	0.1562	0.1539	0.1515	0.1492	0.1469	0.1446	0.1423	0.1401	0.1379
1.1	0.1357	0.1335	0.1314	0.1292	0.1271	0.1251	0.1230	0.1210	0.1190	0.1170
1.2	0.1151	0.1131	0.1112	0.1093	0.1075	0.1056	0.1038	0.1020	0.1003	0.0985
1.3	0.0968	0.0951	0.0934	0.0918	0.0901	0.0885	0.0869	0.0853	0.0838	0.0823
1.4	0.0808	0.0793	0.0778	0.0764	0.0749	0.0735	0.0721	0.0708	0.0694	0.0681
1.5	0.0668	0.0655	0.0643	0.0630	0.0618	0.0606	0.0594	0.0582	0.0571	0.0559
1.6	0.0548	0.0537	0.0526	0.0516	0.0505	0.0495	0.0485	0.0475	0.0465	0.0455
1.7	0.0446	0.0436	0.0427	0.0418	0.0409	0.0401	0.0392	0.0384	0.0375	0.0367
1.8	0.0359	0.0351	0.0344	0.0336	0.0329	0.0322	0.0314	0.0307	0.0301	0.0294
1.9	0.0287	0.0281	0.0274	0.0268	0.0262	0.0256	0.0250	0.0244	0.0239	0.0233
2.0	0.0228	0.0222	0.0217	0.0212	0.0207	0.0202	0.0197	0.0192	0.0188	0.0183
2.1	0.0179	0.0174	0.0170	0.0166	0.0162	0.0158	0.0154	0.0150	0.0146	0.0143
2.2	0.0139	0.0136	0.0132	0.0129	0.0125	0.0122	0.0119	0.0116	0.0113	0.0110
2.3	0.0107	0.0104	0.0102	0.0099	0.0096	0.0094	0.0091	0.0089	0.0087	0.0084
2.4	0.0082	0.0080	0.0078	0.0075	0.0073	0.0071	0.0069	0.0068	0.0066	0.0064
2.5	0.0062	0.0060	0.0059	0.0057	0.0055	0.0054	0.0052	0.0051	0.0049	0.0048
2.6	0.0047	0.0045	0.0044	0.0043	0.0041	0.0040	0.0039	0.0038	0.0037	0.0036
2.7	0.0035	0.0034	0.0033	0.0032	0.0031	0.0030	0.0029	0.0028	0.0027	0.0026
2.8	0.0026	0.0025	0.0024	0.0023	0.0023	0.0022	0.0021	0.0021	0.0020	0.0019
2.9	0.0019	0.0018	0.0018	0.0017	0.0016	0.0016	0.0015	0.0015	0.0014	0.0014
3.0	0.0013	0.0013	0.0013	0.0012	0.0012	0.0011	0.0011	0.0011	0.0010	0.0010
3.1	0.0010	0.0009	0.0009	0.0009	0.0008	0.0008	0.0008	0.0008	0.0007	0.0007
3.2	0.0007	0.0007	0.0006	0.0006	0.0006	0.0006	0.0006	0.0005	0.0005	0.0005
3.3	0.0005	0.0005	0.0005	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0003
3.4	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0002
3.5	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
3.6	0.0002	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
3.7	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
3.8	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
3.9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
4.0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

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